Economics Without Numbers: Teaching Strategies for Math- Lite Students

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Many colleges and universities have minimal math requirements. Business schools don't require the number of math courses they used to. Economics departments have reduced the math requirement for Economics majors. The result is that economics courses are populated with students with little understanding of mathematical concepts. This paper outlines several concrete teaching strategies, organized by economic topic, designed to reach students without strong math backgrounds. In-class exercises, visual demonstrations, stories, and real- world examples are all used to teach economic concepts without relying on mathematical theory.

INTRODUCTION

The "dismal science" as a description of economics did not originate with principles of economics students. Many would not disagree with that statement however. Student descriptions of economics range from boring to impossible. This paper will argue that this does not have to be. The reason that some students have trouble with principles of economics may be that they lack the skills to understand the mathematical concepts on which much of economics is based.

The most prominent method of teaching economics is the lecture (Becker and Watts 1996). This is not the case with the rest of higher education (Sax et al 1996). We believe that Siegfried and Fels (1979) were right when they concluded: "Different students learn economics in different ways. The best teaching strategy provides alternative learning methods". Students enrolled in principles of economics classes often have little prior knowledge of economics or mathematics. The most effective learning takes place when students can make connections between prior knowledge and new information.(Angelo 1992) The way to alleviate this problem is to use examples based on what students know (pizza, board games, concerts, class schedules) and connect them to the new information- economic principles This paper will lay out several concrete examples of this approach.

THE FIRST DAY OF CLASS

The first class meeting sets the tone for the rest of the semester. Students leave the classroom with a perception of how the class is likely to unfold for the semester. Most students in principles of economics classes have not had previous exposure to the study of economics. Given this, most instructors are inclined to give a definition of the study of economics. Invariably, some variation of the following

emerges. "…. The study of how scarce resources are allocated to satisfy unlimited wants". A discussion of basic human needs and allocation of natural resources follows. One can almost visualize students sinking into their chairs and the tone for the semester is set. The "dismal' science has begun for another semester. Students without previous exposure to economic principles have nothing to grab onto.

Consider this alternative. The instructor begins the first day of class with the following question. "How many of you ate breakfast this morning?" A direct, simple question designed to engage all of the students. This question is effective in a classroom of 20 or 200. Assuming a normal distribution of students, there will be both affirmative and negative answers. Begin by asking those who said no, why not. Invariably, someone will answer "I didn't have time". Now the economics lesson begins. Ask the student if he only has 22 hour days. Explain that all of us have the same number of hours in the day and we have to decide how to use them. Those who did not eat breakfast decided to use the time differently-- to sleep, to study, to take a morning jog. The students have made a fundamental economic insight. They have made a decision to allocate a scarce resource-time- to satisfy an unlimited needs. The discussion can continue to illustrate other economic concepts. What did they have for breakfast- tastes and preferences? Do they make different decisions on the weekends then during the week? Do Saturday and Sunday have more than 24 hours? Or is it a different allocation decision?

The students have learned about resource allocation. They have used their own experiences to illustrate an economic concept. The students have used something they are very familiar with- the decision to have breakfast or not –to learn a basic economic theory. No mention of guns and butter or widgets. The students may leave the classroom with the idea that maybe economics is not so dismal after all.

Another first day of class exercise that works well involves the board game "Mouse Trap". Have the students come to the front of the room and build the "Mouse Trap" game. Once it is built, tell them about Rube Goldberg who was a cartoonist who designed fun but convoluted, intricate mechanical devices to do everyday things—like the mouse trap in this game. Once the game is assembled what we have is a set of pieces put in place. But we have more. We have a set of assumptions about the relationships between key outside (exogenous) variables and key inside (endogenous) resulting in equilibrium: the mouse is free but on the square right under the net. In this set of assumptions we have held all the exogenous variables constant; they are in their standard or normal positions. That is, they are ceteris paribus (ceteris like et cetera for all the other stuff and paribus like par in golf at their norm). What we have assembled is a model! Ask someone to turn the crank. Eventually, someone steps up and turns the crank. Then the boot kicks the bucket and the chain of events unfolds with the net coming down on the mouse. There was a change in one of the outside variables—the crank—which is called a "not-ceteris-paribus" event. This event reverberates through all the interconnections of the model and results in a shift in the position of the net to its new lower equilibrium position, trapping the mouse. Now the students have a tangible, visual, special connection to model building, the role of ceteris paribus, equilibrium, and the effects of "not-ceteris-paribus."

THE MARKET

If a new student is going to have much success in economics, he must have a solid understanding of markets and how they work. The traditional approaches may not be effective because most students will have no prior first hand experience with markets. This can be overcome by creating markets inside the classroom. All markets consist of supply and demand. Fortunately, supply and demand schedules can be created using students in the classroom.

Demand usually is the easier of the two for students to understand. This is because they have been demanders from the time they were kids in the candy store. With a little help, students can develop a fairly strong grasp of this concept. The instructor should choose three different goods. Examples would be a food item (local pizza works well), a night out (movies, a play or concert) and a big ticket item (a spring break trip or a car). Callout a series of prices, increasing the price as you go. Ask students if they are willing to purchase the item at this price. Record the results as you collect them. When students will no

longer purchase items, you have finished. You should have a set of prices and quantities demanded recorded. Plot the numbers on a graph and you have created a demand curve for that particular item in the classroom. Students are part of the process, leading to a firmer grasp of the concept.

The instructor can then continue with the determinants of demand (income, tastes and preferences, prices of related goods). Using the same goods, the instructor can then change the conditions. Tell the class that their incomes are now ten times what they were a few seconds ago. Ask them the same questions about how much they would by at various prices. Compare the answers. The students should now have a better understanding of the effect of changes in income as well as normal and inferior goods. The same strategy can then be employed to explain changes in tastes and preferences as well as the prices of other goods.

Most students find supply a more difficult concept to grasp than demand. While they can relate to themselves as demanders, few students have owned or managed businesses. One strategy is to have the students view themselves as suppliers. A method to do this is to create a situation where the students are able to offer their services. The instructor can ask the class how many of them would be willing to cut his grass (or shovel his snow depending on the season) for a dollar. The response should be limited. The instructor can then increase the offer incrementally until almost all of the students have agreed. A supply curve has now been created. Students can understand how at higher prices, a greater quantity will be offered. They have become the supply curve. The process can be repeated with the students being asked to sell their pens or pencils. An additional supply curve can be created. The instructor can then use this data to look at how changes in the conditions that determine supply- technology, cost of inputs, and the prices of related goods- change the responses of the students.

EQUILIBRIUM, SHORTAGES AND SURPLUSES

College campuses are easily incorporated into analysis of how markets work. Most college students have some interest in one or more of their schools sports teams. Attendance at sporting events can be used to illustrate shortages as well as surpluses. Concerts, plays and other performances can be used as well. Choose a popular campus event that sells tickets (football at Notre Dame, basketball at Duke, a U2 concert anywhere). Ask the students what it would cost to attend that week's event. If the demand for tickets is greater than the available seats, the price should be higher than the printed price on the ticket. Students will have first hand experience with how a market responds to a shortage. A surplus can be demonstrated in the same manner. Some events on campus are less popular than others. The prices for these events will be lower. Admission may even be free. This outcome is consistent with a market experiencing a shortage. If the market is allowed the work, the prices for events will adjust to the market conditions.

PRODUCTION POSSIBILITIES CURVES

The traditional methodology for teaching production possibilities is to use the economy as a whole and then construct the curve based on "guns and butter" or "food or cars". The problem with this approach is that the students have no experience with national economic variables. An approach that integrates the student's experiences can be created. Instead of the economy as a whole, the students can be used as the producers. All students earn grades. They do this by combining resources- intelligence, study materials, instructor's lectures and study time to do this. Ask the students how many hours a week they have available to study for two of their courses. These hours then become the resource to be allocated. Assume a student is enrolled in English comp and principles of economics and has ten hours a week to study for these two courses. They can allocate the ten hours any way they wish. The rest of the inputs (intelligence, study skills etc.) are assumed to be fixed. Grades in each course are the commodity to be produced. The levels of production are the possible grades (A-F). If the student uses all ten hours to study economics, he can earn an A in economics but an F in English. The opposite would happen if the student devoted all of the hours to English. A division of the hours equally would result in C's in both

courses. Various combinations of hours will result in various combinations of grades. You have now created a production possibilities curve using concepts which are very familiar to the students -grades and study time.

All of the usual concepts associated with production possibilities analysis can be illustrated with this example. Opportunity cost is easily explained. A grade in economics "costs" a grade in English. If you add more resources (study more hours) you can increase production (earn higher grades). If you increase the productivity of the inputs (develop better study habits) you can increase output (better grades). If the level of capital is increased (better professors, computers in the classroom, better textbooks) output increases (better grades). If you do not employ all of your resources (less than ten hours of study) production falls (you may flunk both courses).

LAW OF DIMINISHING RETURNS

Even before defining the law of diminishing returns or mentioning marginal cost, ask how much the chair they are sitting in costs. As the students shout out their dollar amounts, list them on the board. Look at the range and make it a humorous moment. But that range is a topic for another time. The focus here is that all students tell you how many dollars the chair cost. Then you reveal that as an economist the metal in the chair could have been used in an alternate opportunity as could the oil in the fabric and paint, as could the wood… Stress that opportunity cost precedes dollars. That is the key: before dollar cost there are resources used. This puts the focus on resources, products, and Mother Nature's Recipe for turning resources into a product. Talk about the connection between products and the resources needed to produce them. Use the product whose production process with which you are most familiar. With the background set, you are ready to have the students grow corn.

Draw two farms of equal area on the board—four erasers long and three erasers wide should do but you will find what works best for you with some practice. Select two students to be farmers, one for each plot. Tell them they each get to grow as much corn as they can in 10 seconds by writing CORN in their respective plots. Select a timer. When the timer shouts go, they start writing corn. When the timer shouts stop ten seconds, later they must stop. The timing is crucial. It is the growing season and it is a fixed resource just as the plot of land and the chalk capital are fixed. You count up the corn. Eliminate sloppily written or partially written corn from the count. Make it fun by have the opposing farmers decide what counts in the others farm. But you remain the final say. Now make two columns and record each farmer's production in separate columns. Then harvest, i.e. erase, the year's corn crop. Now repeat. Ask for two more volunteers—one to assist each farmer. Then repeat the 10 second growing season, recording the number of ears of corn grown, and harvesting/erasing the crop. Then repeat with two more volunteers so that there are three workers on each plot. Then repeat again and again. Usually six farmers per plot is the limit. But you can find what works best for you. It depends how big you drew the farm plots and how big the chalk was initially. By the time you have five or six farmers, the chalk pieces have become so small they are no longer divisible and the crowd at the board is so big there is not more room—congestion has set in. Everyone is laughing and having a good old time. Bang! You draw their attention to the columns of corn. You compare the two columns and make two observations. First you observe with more labor there is typically more production. And then you make a second observation, the less anticipated one. You observe that after some point the extra production produced by an extra worker declines. Marginal product is declining after some point! Now you define Marginal Product and the Law of Diminishing Returns. Summarize by restating that the two Rules of Production come from Mother Nature's recipe in the short run when there are fixed resources—in this case the area land and the equipment chalk and the growing season 10 seconds. No money, no unions, no government, no central bank, no international trade just congestion of labor using the fixed resources forces Mother Nature's Recipe to yield smaller additions to production after some point.

INDIFFERENCE CURVES

Another way to make visible indifference curves and get their meaning across requires you to bring coins to class and make a stack coins. Have the students gather around your desk or use the document camera. Take a dime, penny, nickel, quarter, and a silver dollar and stack them up with the silver dollar at the base and the dime at the peak (the order would be from base to peak silver dollar, quarter, nickel, penny, dime). Using the monetary value to represent elevation or utility level, the heights would rise from 100 pennies in the dollar to 125 in the dollar plus quarter to 130 in the dollar, quarter, nickel to 131 in the dollar, quarter, nickel, penny to 141 in the dollar, quarter, nickel, penny, dime. While stacked, spread them a bit exposing their edges but still keeping the coins one on top of another. Then take a pencil and inscribe the arc of the lowest coin, the silver dollar. Remove the silver dollar carefully so that all the other coins remain in their relative position. Then inscribe the arc of the quarter. After inscribing the arc of the quarter, remove it and continue on in similar fashion to the nickel, penny, and dime. What you have is a contour pattern of rising total currency value. The students saw the mountain of coins. The students connect the rising utility level and the contour lines of the coins and the indifference map.

RELATIVE PRICES

The reality of relative price is strengthened further by sending the students on a "Relative Price Treasure Hunt." Send students in pairs to the cafeteria, bursar's office, and the bookstore to find relative prices. Each pair is to find out the price of two goods you assign to them. For example, at the cafeteria have the student pair find the price of a hamburger and the price of a hot dog, at the bursar's office the tuition for an MBA course and an undergraduate course, at the bookstore the price of a notebook and the price of a 2 gig flash drive, and so forth. Before they go ask the class to guess which pair will have the highest relative price? When they get back ask them to report their currency prices and the relative price. And ask each pair of students if they would be willing to pay the relative price to get the other good. Of course before sending the students out in pairs alert the cafeteria, bursar's office, and the bookstore. For those on large campuses where these destinations are remote from your classroom, have the students log onto their laptops and visit appropriate websites.

MACROECONOMICS

Students usually are less familiar with macroeconomics then they are with microeconomics. One approach to this problem is to create a mini-economy in the classroom. Many macroeconomic concepts can be illustrated within the classroom, using the students as parts of the economy.

Students often have a hard time understanding the economy as a circular flow. One person's spending as another person's income is sometime is a difficult concept to grasp. A group of students can be used to illustrate the concept. The instructor can set up a mini-economy using six to ten students. Two or three of the students can be labeled employees. Another two or three can be set up as employers. Another student can be appointed the bank and one more student can be the government. The circular flow concept can now be demonstrated. The employers pay the employees. The employees then have to spend their income. They spend their money with the employers who then use that spending to pay the employees. The banker can now be introduced. If the employees do not want to spend all of their money, they may deposit it in the bank. The owners of businesses may do the same. The bank then lends the money to employees and businesses as the circular flow continues. The bank may keep a small percentage as profits. These profits are now the banker's income which he spends with the business owners. The circular flow continues. The government can now be introduced. The government taxes both the employees and the businesses. The government then turns around and gives the money back to the employees and the businesses in the form of government spending.

THE MULTIPLIER

The multiplier can easily be demonstrated using students in the class. Choose seven to ten students. Determine a marginal propensity to consume. An m.p.c. of 8/10 works well. Announce that you are giving the first student 100 dollars. The student spends 80 dollars and saves 20 dollars. The first student spends the 80 dollars with the student next to him, increasing that student's income by 80 dollars. The second student spends 64 dollars and saves16. The second spends the 64 with the student next to him, increasing their income by that amount. The third student then spends $51.20 and the spending continues. The instructor can explain to the students how the income of the group increases by 100 + 80+64=51.20… as a result of the multiplier. The process can be repeated with a different value for the marginal propensity to consume, demonstrating the connection between the m.p.c. and the magnitude of the multiplier.

Inflation can be easily demonstrated using three or five students in the class (an odd number works best). Designate two of the students as sellers and three as buyers. Give the three buyers an artificial money you have created (pieces of paper work well). Tell the buyer they must purchase the sellers pens. Give the group a few minutes and then determine the prices paid for the pens. Now double the number of slips of paper. Instruct the students to perform the exercise again and watch the prices rise.

The role of the banking system in the creation of money is easily demonstrated using two students and the instructor. The instructor acts as the bank. The first student comes to the bank and deposits 100 dollars in currency. Student number two then comes to the bank for the proceeds of a loan that has already been approved. The bank gives the second student eighty of the100 dollars that the first student has deposited. The bank has created money. The first student can come back to the bank and withdraw his deposit, clearly demonstrating the creation of money. The instructor can then explain to the students as long as everyone does not come at the same time, the system works.

CONCLUSIONS

This paper has set forth concrete methods for alternative, math-lite presentations of economic principles. The common theme to all of the presentation methods is to take what students are familiar with and use these settings to explain economic principles without overwhelming them with numbers. A second theme is to use the students in class as live participants in your classroom. Economics is a social science that makes predictions about human behavior. The more the instructor can involve students in the presentation of the theory, the more effective student learning can be.

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